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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/777,973	02/11/2004	Yunlong Sun	50001/91:2 US	7445

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EXAMINER	
ELVE, MARIA ALEXANDRA	
ART UNIT	**PAPER NUMBER**
1725	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/777,973	SUN ET AL.	
	Examiner	Art Unit	
	M. Alexandra Elve	1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4-5, 8, 11-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Cordingley et al. (USPAP 2002/0167581).

Cordingley et al. discloses an improved thermal based laser method for processing a predetermined microstructure formed on a substrate without causing undesirable changes in electrical and physical characteristics of the substrate or other structures formed on the substrate. Multi-material and layered materials and wafers are processed. Copper links are removed on multilevel devices. Additionally, microscopic holes can be drilled. Laser processing is thermal based. The laser energy used is about 60 to 70% of laser energy required for laser processing.

A q-switched pulse laser may be used, as well as a mode-locked system. Fiber amplification is an option. IR, UV and green spectrum lasers are used to blow copper links. Wavelengths may be chosen based on the substrate properties, with the typically value being 1.047 um. Repetition rates range from 1uHz to 20KHz to 60 MHz (mode lock system). Beam spot, pulse width, energy pulse values are all selected to ensure

optimal processing. Pulse widths of less than 5 nanoseconds are used (few picoseconds to nanoseconds). Multiple pulses may be used (259). In order to limit thermal diffusion and hence negate substrate damage, pulse energies range from 0.1 microjoules to 3 microjoules. The position and depth of focus of the beam is selected to ensure that the substrate is processed without creating undesirable changes to other materials. Additionally, the system normalizes the defocus function. Figure 15a shows the focusing optics and beam guidance. (abstract, figures, 0005, 0007, 0009, 0016, 0024-0029, 0034, 0036, 0046, 0057-0058, 0083-0091, 0095-0096, 0106, 0109, 0112-0113, 0115, 0117-0120, 0122, 0125-0126, 0134, 0137-0152, 0165, 0190, 0193, 0195-0196, 0198, 0200-0201, 0204, 0210, 0220-0221, 0226)

Claims 1-3, 6-7, 9, 11, 13-14, 17-19, 21-22 & 24-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Kennedy et al. (USPN 6,697,408).

Kennedy et al. discloses a Q-switched cavity dumped CO2 laser for material processing. Super pulsed and short pulses are used for hole drilling and so forth. IR, near IR, visible and UV lasers may be used and pulse durations range from milliseconds to femtoseconds. Nanosecond pulses are shorter than the thermal diffusion time. Thus, material removal is vaporization dominated vs. melt expulsion dominated mechanisms for millisecond wide laser pulses. Shorter pulse with yield more limited heat diffusion into the surrounding material during the laser pulse. Thermal and mechanical shocks are reduced with short pulse laser systems. Hole-to-hole dimensional stability is also improved because the hole is drilled by the material being

nibbled away by tens to hundreds of laser pulsed of smaller pulse energy but occurring at a high pulse repetition frequency rather than by a few high-energy pulses. For the same reason, thermal and mechanical shocks from nanosecond pulses are also reduced compared with millisecond pulses. Femtosecond pulses are presently obtained with solid-state lasers. For the same total irradiation laser energy, femtosecond pulses remove two to three times more material than the nanosecond pulses.

Holes are drilled into circuit boards or multi-layer boards using a CO2 laser. Holes may be through holes or blind via holes. Pulse widths of 7 to 20 ns are obtained with CO2 lasers. Pulse durations may be 0.1 μs to 0.2 μs (or 10 to 20 ns). Pulse repetition frequencies of 500 Hz to 100 kHz. For many plastic materials the CO2 laser is 9.2 to 10.6 microns wavelength. Pulse energies range from 0.5 mJ to 0.75 mJ and heat energy is 10W to 6.8 kW. The time interval between pulses is selected based on the optimum time for material removal from the hole before the arrival of the next pulse on the material. In addition to a CO2 laser, semiconductor diode pumped or flash lamp pumped solid-state laser such as YAG lasers are also commonly used in via drilling.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4-5, 12, 15-16, 20 & 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kennedy et al., as stated above and further in view of Cordingley et al.

Kennedy et al. does not disclose the exact wavelength, the spot size, beam steering, or peak power.

Cordingley et al. discloses an improved thermal based laser method for processing a predetermined microstructure formed on a substrate without causing undesirable changes in electrical and physical characteristics of the substrate or other structures formed on the substrate. Multi-material and layered materials and wafers are processed. Copper links are removed on multilevel devices. Additionally, microscopic holes can be drilled. Laser processing is thermal based. The laser energy used is about 60 to 70% of laser energy required for laser processing.

A q-switched pulse laser may be used, as well as a mode-locked system. Fiber amplification is an option. IR, UV and green spectrum lasers are used to blow copper links. Wavelengths may be chosen based on the substrate properties, with the typically value being 1.047 um. Repetition rates range from 1uHz to 20KHz to 60 MHz (mode lock system). Beam spot, pulse width, energy pulse values are all selected to ensure optimal processing. Pulse widths of less than 5 nanoseconds are used (few picoseconds to nanoseconds). Multiple pulses may be used (259). In order to limit thermal diffusion and hence negate substrate damage, pulse energies range from 0.1 microjoules to 3 microjoules. The position and depth of focus of the beam is selected to ensure that the substrate is processed without creating undesirable changes to other

materials. Additionally, the system normalizes the defocus function. Figure 15a shows the focusing optics and beam guidance. (abstract, figures, 0005, 0007, 0009, 0016, 0024-0029, 0034, 0036, 0046, 0057-0058, 0083-0091, 0095-0096, 0106, 0109, 0112-0113, 0115, 0117-0120, 0122, 0125-0126, 0134, 0137-0152, 0165, 0190, 0193, 0195-0196, 0198, 0200-0201, 0204, 0210, 0220-0221, 0226)

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the wavelength, the spot size, beam steering, and peak power, as taught by Cordingley et al. in the Kennedy et al. system because both are directed to material processing using short pulse durations.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cordingley et al., as stated in the above paragraph and further in view of Owen et al. (USPN 5,841,099).

Cordingley et al. teaches drilling holes, but not blind vias.

Owen et al. discloses the use of a q-switched laser to drill vias and blind vias in multilayer materials (metallic and dielectric layers). (abstract)

It would have been obvious to one of ordinary skill in the art at the time of the invention to drill blind vias, as taught by Owen et al. in the Cordingley et al. system because this is merely a specific type of hole drilling.

Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cordingley et al., as stated in the above paragraph and further in view of Fahey et al. (WO 03/002289 A1).

Cordingley et al. discloses the processing of wafers but not dicing.

Fahey et al. discloses the dicing or wafers using an IR laser with differing wavelengths. (abstract)

It would have been obvious to one of ordinary skill in the art at the time of the invention to dice wafers, as taught by Fahey et al. in the Cordingley et al. system because it is merely a specific type of wafer processing.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kennedy et al. as stated above and further in view of Fahey et al.

Kennedy et al. discloses the processing of circuit boards and via drilling, but not the dicing of wafers.

Fahey et al. discloses the dicing or wafers using an IR laser with differing wavelengths. (abstract)

It would have been obvious to one of ordinary skill in the art at the time of the invention to dice wafers, as taught by Fahey et al. in the Kennedy et al. system because all the processing is drawn to the semiconductor industry.

Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cordingley et al. as stated in the above paragraph and further in view of the following.

Cordingley et al. teaches a range of wavelengths, which are selected, based on the processing operations needs. It is well settled that where patentability is predicated upon a change in a condition of prior process, that is, the wavelength, the change must be at least critical, that is, it must lead to a new and unexpected result. The applicant has the burden of providing such proof of criticality. Note In re Aller et al. 105 USPQ 223.

Response to Arguments

Applicant's arguments filed 5/24/07 have been fully considered but they are not persuasive.

Applicant argues that Cordingley et al. does not teach dimensional stability. The examiner respectfully disagrees because, Cordingley et al. discloses an improved thermal based laser method for processing a predetermined microstructure formed on a substrate without causing undesirable changes in electrical and physical characteristics of the substrate or other structures formed on the substrate.

Applicant argues that Cordingley et al. does not teach the use of multiple laser pulses. The examiner respectfully notes that multiple pulses do not appear to be stated in instant claims. Furthermore, it is the examiner's position that a pulse may fulfill both the energy processing and the heating.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Alexandra Elve whose telephone number is 571-272-1173. The examiner can normally be reached on 7:30-4:00 Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jonathan Johnson can be reached on 571-272-1177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

September 29, 2007.

/M. Alexandra Elve/
M. Alexandra Elve
Primary Examiner 1725